

PRIORITIES FOR BAT CONSERVATION

Analysis of the responses to a Questionnaire in July 1989 by the participants of the Eighth International Bat Research Conference

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ABSTRACT

The responses to a questionnaire by the participants to the Eighth International Bat Research Conference in July 1989 showed that there is a strong consensus among researchers about the conservation problems facing bats, particularly regarding the issues of habitat loss and ignorance and prejudice about bats. There was broad agreement that if bat conservation does not achieve a higher profile, then bat habitats will be unknowingly degraded, such as by forest logging, that species' ranges will contract, and species will go extinct. In priority order, the issues identified were: effects of a fragmentation of habitat; effects of logging; surveys of bats at specific locations, or habitats; and effects of mining. For government wildlife agencies, the top priorities were surveys of bats of threatened habitats, insisting on bat studies in environmental impact statements, and education programmes. Priorities in ecological studies were considered to be habitat selection and roost selection, followed by studies of movements and diets. Respondents agreed that there was a value of bat research to broader conservation issues: rainforest plant species benefit from seed dispersal by fruit bats; surveys of bats can assist in the identification of high value areas for nature conservation; and a drop in bat species diversity can indicate a degraded habitat. What emerged from the results was the clear need for greatly increased attention to specific areas in bat conservation, and that bat conservation should move into the public spotlight.

INTRODUCTION

The aim of this paper is to present the results of a questionnaire on bat conservation. As President of the Royal Zoological Society of New South Wales, I had the privilege of giving the welcoming address to the 160 people who attended the Eighth International Bat Research Conference held in the School of Biological Science at the University of New South Wales from 10-15 July 1989. I spoke on the question of establishing priorities for bat conservation and, via a questionnaire, asked for the views of the conference participants.

It surprises many people that bats are mammals. In fact, there is a large number of species of bats among the native mammals of Australia. In the Australian Museum's publication "Australian Mammals", 58 species of bats are shown (Strahan 1983). A few, the megachiroptera, are large, notably the fruit bats popularly called "flying foxes" which may weigh a kilogram and are familiar to most people. But most bats, the microchiroptera, are small, and some are amazingly delicate flying-machines of a mere 5 grams, weighing less than a ten-cent coin. They are unfamiliar, most people never having seen one of these small bats. Some species of bats, both large and small, are numerous and widespread, but there are many species whose range is restricted and whose numbers are few.

The opening address to the Eighth International Bat Research Conference

The host society for this conference is the Royal Zoological Society of NSW. The primary aims of the Society are:

- (a) to promote and advance the science of zoology, and
- (b) to protect, preserve and conserve the indigenous animals of Australia and their associated habitats.

This conference fits perfectly within these aims.

The Society, now in its 111th year, has hosted many zoological conferences, the most recent being in May last year on "Kangaroo harvesting and the conservation of arid and semi-arid lands". It was published in the Society's journal, *The Australian Zoologist*, in August 1988. Copies are available for \$10.

Kangaroos are high profile animals, but bats do not have such a profile, even though their conservation is as important as that of kangaroos. People will come to a conference to argue that eating kangaroos will assist in their conservation, and there may be a parallel case for eating fruit bats, particularly those shot as pests. The Aboriginal people certainly ate them. However, before any government, wildlife agency or researcher could adequately consider the merit of such a proposal, there are many other conservation issues that must first be addressed.

One of the most important is that the priorities for bat conservation have yet to be established.

For the past 20 years I have participated in a wide range of talks, meetings and conferences arguing the case for nature conservation. Bats have rarely rated a mention. This ignorance of their importance becomes self-perpetuating. Students rarely choose to study bats, and granting agencies rarely award funds for work on bats. Further, researchers who propose work on bats are sometimes suspected of pursuing research interests that do not address the important issues in either science or nature conservation.

My personal experience is otherwise. A decade ago I started a long-term project on the effect of logging on the fauna of forests subject to woodchipping. I wondered whether to include bats. In October 1980 I attended the first national bat conference, in Canberra, organized by Dedee Woodside and Greg Richards. I became convinced of the value of studying bats, and indeed they proved to both fascinating scientifically as well as important indicators of the impact of logging. What I also found rewarding was the help I received from so many bat workers, many of whom are at this conference.

I have a proposal to put to you which may help reverse the low regard given to bats as subjects of research. At this international meeting there is a rare opportunity to seek the opinions of skilled and dedicated bat researchers on the priorities for bat conservation. With the assistance of colleagues, I have drafted a questionnaire seeking your views.

Introduction as printed on the questionnaire

The conservation of bats is becoming recognized as an important scientific issue, but there is much work to be done before the concerns of bat researchers are reflected in the broader community. The aim of this questionnaire is to highlight the issues identified by bat workers as being crucial for conserving bats, and to publicise these concerns. The collected views of the participants of the Eighth International Bat Research Conference would make an excellent contribution to establishing the priorities for conserving bats. Questions 1-6 concern your research work, Q 7-10 relate to public communications, Q 11-18 focus on conservation priorities.

Responses to the questionnaire

There were 70 returns. For some questions there were slightly less than 70 responses because not everyone answered each question. The answers are given as a percentage of people who responded to that question.

Q1. What are your research interests?

(a) conservation	18%
(b) wildlife management	13%
(c) ecology	11%
(d) physiology	9%
(e) reproduction	9%
(f) bat/plant interactions	7%
(g) flight modes and foraging strategies	6%
(h) biogeography	6%
(i) acoustic behaviour and echolocation	5%
(j) systematics	5%
(k) functional morphology	5%
(l) energetics	4%
(m) anatomy	2%
(n) other	10%
(The total exceeds 100% because some people work on more than one topic.)	

Q2. Do you work with?

(a) megachiroptera	19%
(b) microchiroptera	54%
(c) both groups	28%

Q3. How long have you been working with bats?

(a) 1-2 yrs	10%
(b) 3-5 yrs	26%
(c) 6-10 yrs	30%
(d) 11-20 yrs	21%
(e) 21 + yrs	13%

Q4. To what countries do your answers apply? (If Australia, which states?)

(a) Australia	48%
(b) North America	12%
(c) Europe	11%
(d) Asia and S.E. Asia	10%
(e) Africa	5%
(f) Central and South America	5%
(g) Pacific Islands	4%
(h) Worldwide	4%
(i) New Guinea and Solomon Islands	1%

Of the 48% of respondents whose answers applied to Australia, the following breakdown is given by state:

(a) New South Wales	56%
(b) Queensland	51%
(c) Victoria	26%
(d) Northern Territory	18%
(e) Tasmania	15%
(f) Australian Capital Territory	10%
(g) Western Australia	10%
(h) South Australia	5%

(The total exceeds 100% because many people have worked in more than one state.)

Q5. Do you work for?

(a) university (staff)	37%
(b) government agency	36%
(c) free-lance	14%
(d) university (student)	9%
(e) other	4%

Q6. Are you involved with bats principally as a?

(a) researcher	81%
(b) wildlife manager	7%
(c) teacher	4%
(d) other	7%

Q7. By comparison with other mammalian orders, bat conservation is?

(a) less well advanced	72%
(b) comparable	21%
(c) more advanced	6%

Q8. Bat conservation is?

(a) is a special issue because bats are different	82%
(b) not a special issue because conservation measures for other animal groups will cover bats	18%

Q9. Do the following public perceptions: (1) hinder bat conservation; (2) rate as unimportant; (3) benefit bat conservation?

	1	2	3
(a) rarely seen in public education	93%	6%	1%
(b) perception of bats as symbols of darkness or evil	88%	10%	1%
(c) pest status of fruit bats	88%	11%	2%
(d) disease carrier (e.g. rabies)	88%	12%	0%
(e) lack of visibility of most species	76%	15%	9%
(f) prejudice about "ugly" faces	75%	25%	0%
(g) poor animals for zoo displays	69%	26%	5%
(h) no commercial value	50%	35%	15%
(i) lack of striking colours	41%	56%	3%
(j) no song or characteristic audible sound	35%	61%	5%

Q10. If bat conservation does not achieve a higher profile, then (1=agree, 2=uncertain, 3=disagree)

	1	2	3
(a) bat habitats will be unknowingly degraded, e.g. forest logging	93%	6%	1%

(b) individual issues, e.g. Mt Etna ghost bats, will be seen only as isolated problems	88%	9%	3%
(c) species' ranges will contract	87%	13%	3%
(d) bats will continue to get little recognition at the expense of other conservation issues	83%	14%	3%
(e) an unknown disservice will be done to future human generations	82%	12%	6%
(f) species will go extinct	71%	26%	3%
(g) species will go extinct before being named	44%	43%	13%

Q11. Which groups of bats should attract conservation resources? 1=top priority; 2=important, but not yet urgent; 3=low priority

	1	2	3
(a) species with known problems, e.g. ghost bat	89%	10%	0%
(b) rare species	79%	19%	0%
(c) rainforest species	64%	28%	6%
(d) cave dwellers	61%	33%	5%
(e) potential indicator species	59%	42%	7%
(f) species dependent upon mature forest	58%	37%	5%
(g) fruit bats	36%	47%	16%
(h) migratory species	23%	61%	15%

Q12. If you were given \$100 000 to carry out a particular bat conservation programme, what proportion would you allocate to:

	(in \$1 000)	
	Mean	Range
(a) research	47	0-100
(b) development of management guidelines	21	0-80
(c) education and public relations	29	0-100

Q13. If you were allocating funds for bat conservation, what would your priority rankings be on the following? (1=high priority; 2=medium; 3=low)

	1	2	3
(a) effects of fragmentation of the habitat	87%	12%	0%
(b) effects of logging	79%	19%	2%
(c) surveys of bats in specific locations or habitats	63%	31%	6%
(d) effects of mining	59%	25%	15%
(e) effects of fire	18%	56%	26%
(f) greenhouse effects	18%	56%	26%
(g) effects of drought	13%	42%	45%

Q14. If you were asked to advise a government wildlife agency on bat conservation, how would you rank the following? (1=top priority; 2=important, but not yet urgent; 3=low priority)

	1	2	3
(a) survey of bats of threatened habitats	91%	7%	1%
(b) insisting on bat studies in environmental impact statements	80%	18%	2%
(c) education programmes	80%	18%	2%
(d) protection of all bat species	77%	15%	8%
(e) studies of rare species	74%	25%	1%
(f) employment of a bat specialist	67%	28%	6%
(g) preparation of species plans of management	60%	38%	1%
(h) preparation of a national atlas	50%	41%	9%
(i) encouraging people to study bats	48%	45%	6%
(j) pesticide studies on bat tissues	40%	36%	24%
(k) necessity for researcher to take voucher specimens	39%	34%	25%
(l) preparation of a field guide	37%	43%	19%
(m) preparation of state-wide atlas	33%	50%	17%

Q15. In ecological studies of bats aimed at bat conservation, how would you rank the following? (1=top priority; 2=important, but not yet urgent; 3=low priority)

	1	2	3
(a) habitat selection	89%	9%	2%
(b) roost selection	85%	14%	2%
(c) movements	57%	38%	5%
(d) diet	57%	32%	11%
(e) population dynamics (rate of change)	42%	54%	5%
(f) populations structure (sex and age ratios)	32%	51%	17%

Q16. What is the efficiency of the following techniques for bat conservation field work? (1=excellent; 2=satisfactory; 3=poor)

	1	2	3
(a) radio-telemetry	47%	42%	11%
(b) sonar detectors	45%	43%	13%
(c) harp traps	41%	54%	6%
(d) mist nets	40%	44%	16%
(e) aluminium arm bands	25%	38%	38%
(f) photography	23%	38%	40%
(g) plastic arm bands	22%	42%	36%
(h) tape recorders	18%	38%	44%
(i) nest boxes	6%	47%	47%

Q17. The demonstrated or potential value of bat research to broader conservation issues are (1=agree; 2=uncertain; 3=disagree)

	1	2	3
(a) rainforest plant species benefit from seed dispersal by fruit bats	91%	9%	0%
(b) surveys of bats can assist in identification of high value areas for nature conservation	84%	15%	1%
(c) a drop in bat species diversity can indicate a degraded habitat	79%	18%	3%
(d) surveys of bats can assist in determining minimum areas for nature conservation	58%	36%	6%
(e) roost selection studies of tree-dwelling bats can reflect needs of other groups, e.g. owls, possums	38%	51%	9%
(f) increase in pest insect numbers can reflect a drop in insectivorous bat numbers	34%	51%	14%

Q18. For fruit bats, are the following conservation issues (1) major; (2) minor; (3) not yet a problem?

	1	2	3
(a) need for long-term studies	95%	5%	0%
(b) shooting or destroying fruit bats in camps	86%	11%	4%
(c) seed dispersal	84%	13%	4%
(d) movement studies	74%	19%	5%
(e) dietary studies	74%	18%	9%
(f) the pest problem	68%	28%	4%
(g) shooting or destroying fruit bats in orchards	67%	26%	7%
(h) population dynamics	60%	29%	11%
(i) need for short-term studies	56%	36%	8%
(j) tree damage by fruit bats	53%	41%	5%
(k) studies of particular camps	51%	42%	5%
(l) historical changes	46%	37%	17%
(m) studies of social behaviour	35%	44%	22%

INTERPRETATION OF RESPONSES

Profile of respondents

Almost three-quarters of the respondents were researchers in government agencies or university staff, there being equal numbers of each. There was a great

deal of background experience, over one-third having worked with bats for more than 10 years. Almost equal numbers were from Australia and overseas. Over two-thirds specialized in either the mega or microchiropterans.

Common ground among the respondents

Were the respondents from Australia and overseas similar or different? To determine this, an Australia vs Rest of the World cross tabulation was made of the responses to three questions which are current issues in Australia:

Effects of Logging (Q13b)

Priority rankings for allocating funds		high	medium	low
Australia	(37 respondents)	84%	14%	3%
Rest of World	(28 respondents)	71%	25%	4%

Effects of Fire (Q13e)

Priority rankings for allocating funds		high	medium	low
Australia	(37 respondents)	20%	63%	17%
Rest of World	(28 respondents)	14%	46%	39%

Drop in species diversity indicating degraded habitat (Q17b)

Australia	(39 respondents)	85%	10%	5%
Rest of World	(28 respondents)	72%	28%	0%

It may therefore be concluded that Australians and people from elsewhere are of like mind, and thus the responses to other questions need not be divided by country.

Were the respondents from universities and government agencies similar or different? To determine this, another cross tabulation was made of the responses to two of the above questions and a third, all of which are current in Australia:

Effects of Logging (Q13b)

Priority rankings for allocating funds		high	medium	low
Government agency	(24 respondents)	75%	25%	0%
University staff	(24 respondents)	79%	17%	4%

Effects of Fire (Q13e)

Priority rankings for allocating funds		high	medium	low
Government agency	(24 respondents)	21%	54%	25%
University staff	(23 respondents)	17%	57%	26%

Priority rankings for conservation (Q14g)

Preparation of species plans of management		high	medium	low
Government agency	(24 respondents)	63%	33%	4%
University staff	(25 respondents)	48%	52%	0%

Again, it may be concluded that respondents from universities and government agencies are of like mind. This uniformity extended even to question 12 concerning the proportional allocation of a \$100 000 fund:

		(in \$1 000)	
		Govt agency Mean	Uni staff Mean
research		47	48
development of management guidelines		23	20
education and public relations		26	31

Thus, once again, the responses to other questions need not be divided by affiliation.

Public communications

Most respondents considered bat conservation to be less well advanced than for other mammalian orders (Q7), although a sizeable proportion (21%) thought they were comparable. Some reasons were given for this. (Fortunately, many people wrote additional information on their questionnaires.) Among the reasons offered were that although some other orders had, overall, received more attention, individual species or genera within those orders had been neglected. Similarly, since a few bat species had received considerable attention, even though most had not, then bats were comparable with other orders on that basis. Only 6% thought bats were in advance of other orders with respect to conservation. Again, in Q8, the great majority (82%) of respondents thought that the bat conservation was a special issue because bats are different. Almost all replies (93%) considered that bat conservation was hindered because bats are rarely mentioned in public education (Q9). Again, almost everyone (88%) thought that the perception of bats as symbols of darkness or evil, as pests (in the case of fruit bats), and as disease carriers (e.g. rabies) were major factors hindering bat conservation. At the other end of the scale, the lack of striking colours and the lack of song or characteristic audible sound was not considered to be of great consequence. It was even pointed out that many bats, such as those in Northern Australia, do have bright colours, but people rarely see them. Collectively, these three questions on public communications show that bats are in the dark both literally and metaphorically as a public conservation issue.

Conservation priorities

Almost everyone (93%) agreed in question 10 that if bat conservation does not achieve a higher profile, then bat habitats will be unknowingly degraded, such as by forest logging. Similarly, it was agreed that individual issues, such as Mt Etna ghost bats, will be seen only as isolated problems, that species' ranges will contract, and species will go extinct if bat conservation does not achieve a higher profile. This can be taken as a clear warning that bat conservation is not a trivial concern because the threats to bats are as real, widespread and as directly related to the land-use and land management decisions that face other animal groups.

In endeavouring to determine whether any groups of bats should attract conservation resources, there was a high degree of concurrence (89%) that species with known problems, such as the ghost bat, should be the top priority. Similarly, rare species received general support (79%). Migratory species and fruit bats were not considered to be a top priority, although 61% and 47% respectively of respondents considered these two groups to be important, though not yet urgent. No group was thought to be of low priority, so in seeking to find where to emphasize bat conservation, the subject needs to be tackled from other directions.

When researchers were asked how they would allocate \$100 000 for a bat conservation programme among research, management and education, research was regarded as the most important component. However, management and education combined were voted a slightly larger share of the money. It may be concluded that although research is seen as essential, the importance of following through to the development of management guidelines and promotion of the problems and solutions through education and public relations is also seen as vital. There was much variation on how to allocate the money, so it won't be surprising to see wide variation among programmes in the future. However, it is now quite clear that no component alone will solve the issues of bat conservation, so researchers, managers and educators need to combine their skills.

In response to the question (Q13) about the ranking of priorities in the funding of bat conservation, the two outstanding issues were effects of fragmentation of habitat and effects of logging (87% and 79% respectively for top priority ranking). Surveys of bats on specific locations, or habitats, and effects of mining, were also considered high priority by 63% and 59% of respondents. Effects of fire, drought and greenhouse were considered to be medium to low priority problems. In fact, the responses to this question show a high level of discrimination by respondents when considering the question, in contrast to the impression, one can get during discussions

that everything is top priority. With respect to the details of the responses, the conclusion can be drawn that loss and fragmentation of forest habitat is a top priority issue, closely followed by the need to survey and conserve specific locations, including areas threatened by mining. Environmental change within habitats by fire, drought, or greenhouse effects, are considered to be a lower priority.

As an addition to Q13, respondents were asked to list up to 5 habitats or locations when considering bat conservation priorities. No less than 18 habitats were named: rainforests, eucalypt forest, deciduous forest, mallee, river redgum forests, coastal areas, arid zone, cold climate areas, islands, altered or cleared areas, savannah, wetlands, caves, temples, buildings, mines, remnant habitats, urban areas. Further, 11 locations were named: Central and South America, Pacific, protected and unprotected areas, southeast forests of NSW, Gippsland (Victoria), Tasmanian forests, Karri and Jarrah forests of Western Australia, Central Australia, Kimberly, North Queensland, Northern Territory and Arnhemland. These listings give a clear indication that areas within Australia could be identified for specific attention. Overall, there is still much to do before researchers agree that bats have been well surveyed and their habitats protected.

When asked how to advise a government wildlife agency on bat conservation priorities (Q14), the top priority items were survey of bats in threatened habitats (91%), inclusion of bat studies in environmental impact statements (80%), and education programmes (80%). The preparation of field guides and atlases were seen as important but not yet urgent. Thus, habitat protection, environmental impacts, and education were given top priority. As an addition to this question, respondents were also asked to list other items. Some responses were merely variations on the options available, but additional ideas were: national co-ordination of bat interest groups; controlling the activities of pest control companies; access to banding records; speed in licence processing; access to national parks and reserves; availability of grants for bat research; taxonomic work; compilation of bibliographies. These additional suggestions show that if effort were concentrated in this area, then an extensive and effective set of programmes could be achieved to enhance bat conservation.

In the question on priority ranking in ecological studies aimed at bat conservation (Q15), habitat selection (89%) and roost selection (85%) were deemed to be the most important. Studies of movements and diet (57% each) were next, and population studies were considered to be important but not yet urgent. These responses may be considered to reflect the importance of habitat and roosts in the conservation of bats. This is the information

necessary to support claims for conserving habitat, such as in areas threatened by fragmentation and by logging.

Concerning Q16 on efficiency of techniques, it is noteworthy that although radio-telemetry, sonar detectors, harp traps, and mist nets were rated as excellent by between 40% and 50% of the respondents, no one technique was rated as excellent by more than one-half the respondents. This confirms that bats are hard to study and that there is room for improvement in the field techniques. However, in the practical situation, if a technique is "satisfactory" it will get the results that are needed. The above four techniques were rated as satisfactory or better by over 80% of respondents, and none of the named techniques were considered "poor" by a majority. But, in retrospect, this question could perhaps have been better formulated in that it was not clear whether responses based on experience were asked for. As an example, it is possible that a number of respondents would not have had sufficient experience with radio-telemetry or sonar detection in the field to assess their overall advantages and limitations compared with less sophisticated techniques. When asked to name other techniques, the following were nominated: ultra-violet dyes, night vision devices, passive integrated transponders, cave and building searches, spotlighting, attend tree-felling operations, trip lines, competent observers, reflective tape, bead chain bands, and flying fox food tree lists. These suggestions further indicate the need to be imaginative, and use whatever works. The response to this question suggests that publication of the details of procedures involved in the various techniques would be valuable, including assessment of their effectiveness compared with their cost and the experience needed in their operation.

Many respondents agreed in question 17 that there is a demonstrated or potential value of bat research to broader conservation issues. The outstanding items were that rainforest plant species benefit from seed dispersal by fruit bats (91%), that surveys of bats can assist in identification of high value areas for nature conservation (89%) and that a drop in bat species diversity can indicate a degraded habitat (79%). Again, habitat conservation figures highly, but of considerable importance is the recognition that bats, in this case fruit bats dispersing seeds, are an integral part of ecosystems. When asked to list more issues, the following were raised: susceptibility studies, nectar flow and movements relevant to protecting orchards; eucalypt species, and other open forest tree species, benefit from pollen transfer by flying foxes; drop in numbers of bats, i.e. repeated censuses, can show effects of resource (e.g. roost) loss; epidemiology of diseases; human interactions, and perceptions of bats. This brief list indicates bats are considered integral to their environment, and that interference with the environment, or the bats themselves, has many ramifications.

The final question (Q18) was about fruit bats. The six Australian species generally known as "flying foxes" are a special problem because of their propensity to eat orchard fruit. Some of these species roost in very large numbers in "camps", much disliked by orchardists. The major conservation issues were the need for long-term studies (95%), the shooting or destruction of fruit bats in camps (86%) and seed dispersal (84%). Movement and dietary studies (71% each) were also major issues. Only interactions with beekeepers was considered to not yet be a problem (11%). A number of other issues, such as tree damage by fruit bats, historical changes, population studies, studies of particular camps, were bracketed between 46% and 60% and ranked as major problems. This suggests that there is a potentially long list of issues worth studying, that these would be adjuncts to long-term studies of movements and diet, and that camps need protection. Respondents were asked to list other issues, and the following suggestions were made for further research: attitudes of politicians and landholders; monitoring of population levels, and development of accurate techniques with reasonable confidence levels; the commercial flying fox trade; pollination studies; population studies on Pacific Islands; role of flying foxes in exotic disease transmission; education; bad public image; and captive breeding for highly endangered island populations. This additional list of issues reveals that flying foxes are considered a pest in many parts of Australia while related species are highly endangered in many Pacific Islands.

CONCLUDING REMARKS

It is not surprising that bat researchers think that bat conservation is important. What is reassuring is that there is a strong consensus among researchers about the conservation problems facing bats. What emerged from the results was that there is a strong case for increased attention to specific areas in bat conservation, and that bat conservation should move into the public spotlight.

Collectively, the responses to all questions show a widespread and deep concern for bat conservation, particularly regarding the issues of habitat loss and ignorance and prejudice about bats. The responses also show that the problems can be identified, ranked and followed through from field survey, to habitat and roost selection studies, then to land acquisition or other protection measures. The concurrence between government employees and university staff, and Australian and overseas workers, reinforces the conclusion that there is a common concern. For those people who are studying bats, managing wildlife and forests, preparing and reviewing environmental impact statements, managing special sites for bats, have rare bats or bat sites on their

land, or are advising on the allocation of funds, staff, research and management projects, there is much in the results of this questionnaire to help in the formulation of bat conservation programmes.

ACKNOWLEDGEMENTS

I am indebted to M. Augee, J. Barker, P. Eby, L. Llewellyn and P. O'Connor for critical comments on the draft questionnaire, to all those people who took the time to reply to the questionnaire, to P. O'Connor for computing the results, to P. Eby for advice on computing, and to I. Dunn, P. Eby, T. Flannery, S. Hand and H. Parnaby for their critical comments on the manuscript, and C. Buckley for typing the questionnaire and the manuscript.

REFERENCES

- STRAHAN, R., ed. 1983. *The Complete Book of Australian Mammals*. The Australian Museum and Angus and Robertson, Sydney.

BOOK REVIEW

Studies of Mascarene Island Birds

A. W. Diamond (ed) 1987

Cambridge University press, Cambridge

The *Studies of Mascarene Island Birds* is a report on an expedition, promoted by the British Ornithologists' Union, to the Mascarene Islands. The better known islands of this group include Mauritius, Reunion and Rodrigues. Mauritius was home of the Dodo *Raphus cucullatus*, one of the earliest and most celebrated extinctions of an island species which can be attributed to the spread of Western civilization. Mauritius was known to Arab navigators, but the first European description of the island is attributed to the Dutch in 1598 who colonized it early in the 16th century. Shortly after 1640 the Dodo was extinct. The BOU expedition was initiated to study the endangered fauna of the Mascarene Islands with the laudable objective of providing sound, scientifically based knowledge for the conservation of the islands' surviving wildlife. In his Foreword to the book, Guy Mountfort refers to the "importance and urgency of the work of the BOU expedition". The main part of the expedition appears to have taken place during 1974 and 75 with some work pursued into the early 1980's. In line with the "importance and urgency" of the expedition, results appear to have been communicated to the relevant authorities long before the publication of this book. Unfortunately this summary account of the BOU's work fails to provide a set of recommendations for the conservation and management of the islands' birds. Given the similarity to the pattern of events on the Mascarenes to what is happening to avifaunas worldwide, such a summary would have been most useful.

Mascarene Island Birds is primarily a natural history account of the avifauna of Mauritius, Reunion and Rodrigues Islands. There are few quantitative data and much of this relates

to measurements of birds and eggs (derived in part from museum material). A few species were studied in more detail, for example the Rodrigues Fody *Foudia flavicans* and the Mauritius Kestrel *Falco punctatus*, and these accounts provide more detailed information on behaviour, foraging habits and population size. The data presented are a strange mix of detailed morphological measurements, sonagrams, moult patterns, parasitic infections, foraging behaviour, territory maps, clutch sizes and breeding success. These are presented in great detail for some species and not at all for others. Although it is stated that obtaining a complete record of the vocalizations of all the bird species was a major objective of the expedition, there is no explanation as to why this was considered important. Apart from recording vocalizations and the more detailed studies of individual species (some of which at least were selected because they were endangered), much of the data appear to have been obtained opportunistically. The emphasis on vocalizations, taxonomy and morphological measurements with just a touch of behavioural and ecological data give the whole expedition a distinctly 19th century image.

For all that, there are some interesting species accounts and no doubt the information has been useful in fostering the conservation of the islands' avifaunas. Apart from a more affordable price, I would have liked the book to include photographs of habitats and birds (there are none), some decent maps (none of the whole island group and rather poor ones of individual islands and localities), and some simple summary tables of the major findings (number of extinct species, species associations and so on). The data are there, but too often it is left to the reader to find it.

The strength of the book is in its account of changes to the islands' avifaunas following European settlement and the analysis of causal factors leading to decline and extinction of species. Although depressingly similar to events in Australia, the historical account of ecological events on the Mascarenes by A. S. Cheke following European settlement is fascinating reading. The information presented would be useful to people attempting to understand Australia's post-European ecological problems. Unfortunately the price (A\$234) will stop most people and libraries from purchasing a copy. Given that the book could be photocopied for around A\$25 and that the major objective of writing books of this sort is the dissemination of knowledge, I really must question the merits of publishing this book at all. A cheap set of photocopies would be much more useful. The book itself is not expensively produced and when compared to several recent Australian publications of a similar nature, but which contain excellent colour reproductions, it is hard to see where the cost comes from.

The prohibitive cost of this book raises the question as to whether or not one should bother reviewing material that so few people will have access to. It also raises the question as to whether or not material published in such books (or for that matter, some of the more expensive journals, such as *Oecologia*) should be cited in publications. Perhaps it is time for scientists, authors and the public alike to consider other, less expensive and more rapid forms of communication for the dissemination of scientific results than the printed word. Certainly, if we want to have an impact on the rapidly escalating costs of publication, we need to look critically not only at what we purchase, but the sources of information we cite in papers and where we submit our own work for publication.

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